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ABSTRACT

Creating a searchable multimedia teacher-education database requires a thesaurus control language for categorizing and labeling sequences in multimedia artifacts. This language must be based on a conceptual hierarchy that is authentic to teacher educators and teachers, and also capable of meeting the constraints of computer programmers. The present work aims to develop such a database. One aspect entails developing an authentic language for teacher education capable of embracing the richness of text, multimedia, and hypertext, and also for supporting archiving functions so that educators can add as well as access resources. This paper looks at a key aspect of developing that database, the language needed for categorizing, and retrieving information. Essentially, the challenge entails identifying or developing a language that is authentic to teacher education and teachers, appropriate for coding text and multimedia resources, and compatible with computer programming requirements. (Contains 25 references.) (MVL)

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Developing an Authentic Language for a Web-Searchable, Hypermedia Teacher – Education - Database

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DEVELOPING AN AUTHENTIC LANGUAGE FOR A WEB-SEARCHABLE, HYPERMEDIA TEACHER –EDUCATION-DATABASE

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Overview

Several factors point to the need to explore alternative technology solutions for teacher education, including mitigating science teacher shortages, supporting novice teachers and their mentors, and helping to ensure continuous professional development of inservice teachers.

Teachers and teacher educators currently have access to such searchable repositories as the Educational Resources Information Center (ERIC, http://www.ericse.org/), the Eisenhower National Clearinghouse for Mathematics and Science (ENC, http://www.enc.org/). Teachers are familiar with the thesaurus and descriptors these databases use to structure their searches. But at present, both databases are limited to printed text and graphics, and do not include media, such as sound recordings, digital images, or recordings from video tapes, laser disks, compact disks (CDs), or digital video disks.

Technology today supports integration of media with text-based resources. For example, *SciLinks* enables teachers to locate resources specific to the textbook. Teachers go to the *SciLinks* web site and input one of the codes that is printed throughout their textbook. Teachers need this code to access the resources on the Web annotated in their textbook.

Moreover, the Internet offers untold other resources and supports multimedia capabilities and hyperlinking. Well-designed web sites provide navigation tools that

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facilitate within-site information location, and many contain hyperlinks to other Internet resources. In addition, we now have powerful web browsers capable of searching across and within Internet sites to locate information. At present, however, these perform non-discriminatory, literal searches that seek to match user terms with language from online text or found embedded as metatags (key words). Thus, even though technology enables a teacher or teacher educator to "locate" a lot of information, the results must be winnowed to separate appropriate from inappropriate resources.

At present, teacher educators do not have a searchable database that provides access to multimedia instructional resources. As an example, teacher educators do not have a way to readily search for specific kinds of sequences within videos depicting classroom practices. A teacher education database might include such categorizes as examples of direct teaching and inquiry approaches, of differentiating instruction, or a host of other topics relevant to teacher preparation and professional development. Such a database should not only be designed specifically for teacher education, but also be easy to use both in classrooms and at home as a personal learning tool.

Creating a searchable multimedia teacher-education database requires a thesaurus control language for categorizing and labeling sequences in multimedia artifacts. This language must be based on a conceptual hierarchy that is authentic to teacher educators and teachers, and also capable of meeting the constraints of computer programmers. Our present work aims to develop such a database. One aspect entails developing an authentic language for teacher education capable of embracing the richness of text, multimedia, and hypertext, and also for supporting archiving functions so that educators can add as well as access resources. This paper looks at a key aspect of developing that database, the language needed for categorizing and retrieving information. Essentially, the challenge entails identifying or developing a language that is authentic to teacher

education and teachers, appropriate for coding text and multimedia resources, and compatible with computer programming requirements.

Prototype Databases

Arguably, the best approach for explaining our present database work is to describe in more detail how it stems from our prior efforts and progress in developing computer-assisted multi-media solutions for science teachers. One of the earliest of our efforts grew out of the need to enrich and enhance *The Fluid Earth* (Klemm, Pottenger, Speitel, Reed and Coopersmith, 1990) and *The Living Ocean* (Klemm, Reed, Pottenger, Porter, and Speitel, 1995). These textbooks book are part of the constructivist Hawaii Marine Science (HMSS) program, which was developed at the Curriculum Research and Development Group in the College of Education at the University of Hawaii. They have been adopted and used by teachers throughout the U.S. mainland and Pacific, and received national recognition for their inquiry-based, "hands-on, minds-on" approaches to teaching and learning. For the most part, the HMSS materials are disseminated via HMSS teacher workshops.

HMSS students are actively engaged in learning throughout the program, and they learn content through the inquiry process, not from reading text. The HMSS activities engage students in examining marine specimens and realia, and in constructing and testing maps, models and simulations. A characteristic of the marine sciences is that they study real-world phenomena, much of which can readily observed using photographs, videos and other visual and audio recording devices. The coupling of computers with satellite and underwater technologies made imaging and computer simulation important tools used by those who study the oceans. However, the two HMSS books are print-based, with black and white graphical illustrations of procedures and few diagrams of concepts, the later by design because the focus is on students engaging in inquiry.

Teachers using HMSS are encouraged to responsibly collect and use marine realia (Klemm, 1990). Although the basic ideas in the HMSS program can be taught and learned successfully with relatively few resources, visual images in particular greatly enhance not only the concepts being learned but also their connection to real world marine contexts.

Thus, a CD was developed containing visual and audio enhancement of the two HMSS books. Development of the CD was undertaken to address the needs of teachers in inclusive marine science classrooms (Speitel, Iding & Klemm, 1999) The CD was designed so teachers could readily locate resources appropriate to specific portions of the HMSS books. For example, the CD provides audio pronunciation of new terms, given together with images (drawings, digital images or video) to illustrate them. The CD contains many images of plants, animals and environments studied in HMSS. It also provides enrichment of the text in the form of digital images and video of specific phenomena (e.g., a whale breaching) and procedures (e.g., how to make fish prints or use an orange to make a globe of the world).

When HMSS classroom teachers used the CD, they liked having access to multi-media, program-specific resources, but also wanted to be able to easily link these with other Web resources. Thus, the School Web of Instruction Media (SWIM) database was created, putting the CD onto the Web. SWIM provides a searchable database that allows for easy access to instructional resources pertinent to HMSS, with different levels of access for teachers and their students. The media resources included in the SWIM database are directly linked to specific activities and pages in HMSS books. Included in this database are images, pictures, video, sound, text and computer programmed materials, plus examples, translations, definitions, quizzes, further explanations, and interactive animations and simulations.

HMSS educators and scientists searched through the Web to locate and review resources appropriate to specific concepts, processes or environments investigated in the HMSS program. The materials in the original HMSS CD disk (which is no longer available) are all now available through the SWIM database, and these have been further augmented with carefully selected hyperlinks to other web-based information. Teachers who use SWIM can also contribute to the database. The resulting SWIM database is a searchable multimedia connectivity database. It does not contain the images or multimedia, but instead, serves as a search vehicle capable of connecting the use to pertinent, selected resources (including CDs and other Web sites). Resources are selected by content experts and experienced HMSS teachers. These selected resources are useful to a wide range of students and teachers who are interested in marine science topics and activities, not limited to just those using HMSS.

From our experiences in creating SWIM, we realized that such a database could also be developed to provide teacher educators and teachers with searchable access to examples of content, pedagogy and assessment. Thus, work on SWIM led to our present work in developing the Teacher Education Component of the SWIM database (TEd-SWIM).

Relevance to Science Teacher Education

The need for a web-searchable, multimedia teacher-education database is particularly compelling for several reasons, including those reported by Darling Hammond (1997, 2000a, 2000b) as existing shortages of science teachers, expected large numbers of retiring inservice teachers, the hiring of under-qualified teachers, the exodus of too many novice teachers from classroom teaching, and the lack of qualified mentors or support for mentoring. Needs include helping teachers develop a repertoire of teaching and learning strategies, including constructivist teaching approaches; facilitating

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their development of competencies for enhancing science instruction with technology (Harry & Carbonne, 2000); and supporting their efforts in creating learner-centered, resource rich learning environments (Bodzin, 1998).

The Teacher Education Component of SWIM (TEd-SWIM) that is discussed in this paper is currently in prototype development and testing, building on the capabilities of the original, tested SWIM database. According to Klemm, Iding, Speitel and Nuygen (2002), a teacher education database should have these capabilities:

1. Support the developmental stages in teacher preparation and professional development;

2. Address standards for teacher preparation and teaching (See Appendix);

3. Offer multiple strategies and models for teaching and learning, including behaviorist and constructivist approaches, which exemplify research-based validated practices,

4. Include the subject matter, pedagogy and pedagogical content knowledge of science teachers and teacher educators in a way that addresses their instructional needs (e.g., developmentally appropriate, differentiated instruction);

5. Model integrated instructional technology practice to enhance learning, productivity, and creativity (International Society for Technology in Education, 1996, 1997); and

6. Embrace an authentic language for theory and practice, and use this for developing a virtual professional development database for teachers.

A salient question in developing this language is-"authentic to whom?" Hence, we are now in the early stages of designing a prototype language for the TEd-SWIM database. Our development team includes experienced teachers and teacher educators as well as instructional designers, computer programmers and computer engineers. Our work entails envisioning the users and their needs, and designing prototypes of a language structure that makes sense to them. We will embed this language visibly in the search options and invisibly in categorizing and cross-linking media resources. This language syntax must be familiar and useful to teacher educators and teachers, and also be compatible with the constraints imposed by computer programming logic.

Theoretical and Methodological Background

Research reported by others engaged in similar work forms a theoretical foundation for our work. Harry & Carbonne (2000), Lewis & O'Brien (1998), Lewis & O'Brien (2001), and Zembal-kSaul, Boardman & Dana (2000) report on merits and limitations of multi-media, web accessible teacher education and professional development, which we consider in our design. We also look for use of language in research on telecommunications for networking and electronic professional development (Bodzin & Park, 1998; Bodzin, 2000; Hammer & DiMauroLavole & Foster; MaKinster, Barab & Keating, 2001; Spector, Burkett, Barnes & Johnson, 2000; Whitworth, 1999) and at the nature of sites related to web-based curriculum design (Bodzin, Wilson & Hug, 2000; Spector, Burkett, Barnes & Johnson, 2000). In addition, we have been examining our own experiences in teaching undergraduate and graduate education courses, including our actual and potential future use of media.

Working in small focus groups, we are in the early stages of identifying terms and deliberating on ways to group them, a necessary step in order to design Web pull-down menus, and within-site links. We began testing preliminary ideas for our database language, testing how we would use terms when viewing videotape segments of science teachers and students engaged in teaching and learning. As we do so, we test the adequacy of our evolving language set to see whether it addresses the intended use of the video or other media. We also consider how that video segment might be repurposed. For example, a video segment depicting inquiry could also be used to show a way for organizing and managing a science classroom to support inquiry. We are currently seeking funds to support this research and to involve other educators in the development of this database. Support to date came from federal, state, and University of Hawaii funds.

The TEd-SWIM database is in its early design and prototype testing stages. Although it currently focuses on science education, we believe that if we are successful and the language system we develop is authentic to science teacher education, that much of it will be applicable to other areas of teacher education as well. Persons interested in our work are encouraged to visit the original SWIM database, which is available at http://www.hawaii.edu/swim/.

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Appendix

Standards for Teachers and Teaching

The Interstate New Teacher Assessment and Support Consortium Standards
(Available: http://www.ccsso.org/acadfact.html)

The National Board for Professional Teaching Standards
(Available http://www.nbpts.org/)

The National Council for Accreditation of Teacher Education
(Available:http://www.ncate.org/)

International Society for Technology in Education
(Available: http://www.iste/org/)